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PATENT SPECIFICATION

Application Date: June 21, 1939. No. 18118/39. 530,342

Complete Specification Left: April 26, 1940.

Complete Specification Accepted: Dec. 10, 1940.

PROVISIONAL SPECIFICATION

Improvements in or relating to Roller Bearings, particularly for Aircraft Shock Absorbers

We, THE RIBBESFORD COMPANY LIMITED, a British Company, of Brock House, Langham Street, London, W.1, and JOHN HENRY ONIONS, a British Subject, of the Company's address, do hereby declare the nature of this invention to be as follows:—

This invention relates to roller bearings, particularly for aircraft shock absorbers.

It is the primary object of the present invention to provide a simple and light form of roller journal bearing which is relatively simple to manufacture and is efficient in service.

In a roller journal bearing according to the invention, a plurality of resilient rollers, conveniently composed of helical wire coils, are mounted within a support member comprising a tube which has one of its curved surfaces arranged to serve as a track for the rollers, and is formed at axially spaced positions with a pair of radial flanges engaging with the ends of the rollers. Preferably, the flanges are shaped to produce annular grooves which face one another and which positively locate the rollers. These flanges can conveniently be produced by turning over the ends of a metal tube constituting the support member, the end parts of the spring rollers being reduced in diameter with a view to reducing correspondingly the extent to which the flanges project from the surface of the support member forming the track.

In one construction of roller bearing according to the invention the support member comprises a length of relatively large diameter tube, the two ends of which are spun or pressed outwardly so that they curl over towards one another, thus producing around the outside of the tube two radial flanges constituting annular grooves directed axially towards one another. The exterior of the curved surface of the tube constitutes the track for a number of roller bearings, each of which comprises a closely coiled helical spring preferably ground so that its exterior forms a true and continuous cylindrical surface. At each end the roller is reduced in diameter preferably in a conical or frusto-conical form so that the two ends of the roller engage within the annular grooves when said roller is fully straightened with its axis lying parallel with the tube axis. These reduced end portions can, of course, be made either by successively reducing the diameter of the wire turns or else by inserting plugs or pins within the ends of the spring rollers. Although the rollers are normally held by the two flanges it will, of course, be apparent that the bearing can be assembled and taken apart readily by deflecting the rollers, thereby reducing their length sufficient for them to be withdrawn one end at a time from the grooves in the support member.

The number of rollers is preferably such that when the bearing is in use they extend side by side contiguously leaving only just sufficient play to ensure free rotation, although of course it will be appreciated that in some cases a cage may be incorporated having bars lying between adjacent rollers to keep the latter apart and possibly to maintain them in parallel relationship with regard to the axis of the support member. Further, it may be desirable in some cases to arrange for the support member to lie outside the rollers, in which case the flanges would be directed radially inwards.

When the bearing is installed to reduce friction between a pair of relatively rotatable parts the support member is carried fixedly by one of said parts and the rollers are adapted to engage snugly with a track formed upon the other part. Thus, only one of said parts need be of sufficient hardness to withstand the action of the rollers as the other is protected by the support member, while the resilience afforded by the spring type of roller to a large extent eliminates the indentation of the tracks caused by mechanical vibration.

The invention is particularly intended for use on aircraft, such for example in the elbow joints of the V-linkages used to prevent rotation of shock absorber legs, but of course it is applicable wherever a relatively light roller bearing is required.

[*Price* 1/-]

for reducing the friction in a journal bearing.

Dated this 21st day of June, 1939.

For the Applicants,
F. J. CLEVELAND & COMPANY,
Chartered Patent Agents,
29, Southampton Buildings,
Chancery Lane, London, W.C.2.

COMPLETE SPECIFICATION

Improvements in or relating to Roller Bearings, particularly for Aircraft Shock Absorbers

We, THE RIBBESFORD COMPANY LIMITED, a British Company, of Brock House, Langham Street, London, W.1. and JOHN HENRY ONIONS, a British Subject, of the Company's address, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to roller bearings, particularly for aircraft shock absorbers.

It is the primary object of the present invention to provide a simple and light form of roller journal bearing which is easy and cheap to manufacture and is efficient in service.

According to the invention a roller journal bearing comprises in combination a tubular member forming one race, a plurality of rollers composed of helically wound wire coils, and means upon said tubular member for engaging and retaining the ends of the rollers to hold said rollers in position against the surface of the tubular member. The other race can conveniently be constituted by the surface of one of the members between which the roller bearing is required to operate. Rollers of the helically wound form are very useful with this type of bearing as, being flexible, they tend to assume an oval shape in cross-section, thus reducing the likelihood of indentation.

According to a further feature of the invention a roller journal bearing is provided comprising an inner tubular race, an outer tubular race, and a plurality of rollers composed of helically wound coils, one of said races being formed at each end with a radial flange having an axially directed annular groove within which the ends of the rollers engage and by which they are retained so that the rollers form a unit with the said one race. Preferably the end parts of the rollers are of reduced diameter to engage with the retaining means upon said one race, both ends of each roller conveniently being of frusto-conical shape to engage with the retaining means of the said one race. These frusto-conical parts can conveniently be produced by successively reducing the diameter of those convolutions disposed at the ends of said roller. Alternatively there may be provided at each end of each roller a portion of reduced diameter comprising a pin or equivalent, such as a short length of tube, inserted into the end convolutions of the roller.

In order to avoid grooving the races as the roller bearing wears, and also with a view to avoiding endwise displacement of the parts due to the "screwing" action of the helically coiled rollers, the latter are preferably arranged so that some are wound in one direction (e.g. clockwise), the remainder being wound in the opposite direction (e.g. anti-clockwise), alternate rollers conveniently being composed of clockwise helices, while the intervening rollers are composed of anti-clockwise helices.

The above-mentioned one race may be composed of thin metal tube, the end parts of which are turned back by spinning, pressing or the like to produce a pair of annular grooves for retaining the ends of the rollers in a manner which is already known for bearings having rollers of the solid variety. Thus one race may be formed with the retaining means, while the other race has a pair of inwardly directed flanges whereby it is retained axially in relation to the rollers and the inner race, or is in the form of a plain tube which is located against axial displacement by its ends engaging with the edges of the retaining flanges of the said one race. The said other race may be split so that it can be enlarged or reduced in diameter to permit assembly, the split preferably being arranged obliquely with respect to the axes of the adjacent rollers in order to enable the rollers to pass smoothly from one side of the split to the other.

The invention is illustrated by way of example in the accompanying diagrammatic drawings, in which: Figure 1 is a side elevation of an improved roller bearing shown partly in section, the members between which the bearing operates being indicated in broken lines;

Figure 2 is a fragmentary radial section taken through the bearing to illustrate the method by which the rollers are assembled and removed;

Figure 3 is a fragmentary radial section showing the roller bearing arranged with the race upon the outside;

Figure 4 is a side elevation, partly in section, showing a modified arrangement incorporating inner and outer races;

Figure 5 is a part sectional side elevation of a modified construction; and

Figure 6 is a fragmentary sectional view of a still further modification.

The roller bearing shown in Figure 1 comprises a tubular member 10 which serves as the inner race for a circumferential series of rollers 11. The tubular member 10 fits snugly upon an inner member such as a shaft or stub axle indicated in broken lines at 12, while the rollers 11 are arranged to engage directly with an outer member 13 having an internal cylindrical surface 14 adapted to act as an outer race. The rollers 11 are composed of helical coils of stiff wire such as hard steel, these being closely wound so that the adjacent turns bear against one another. The exterior of each roller is ground to form a substantially continuous cylindrical surface 15 which extends for the major part of the length of the roller, the grinding of course preferably being done after any hardening and tempering operations have been carried out. At its two ends each of the rollers is progressively reduced in diameter to form frusto-conical portions 16, this conveniently being effected by progressively reducing the diameter of the end convolutions during the winding of the wire, as will be clear from Figure 1. These end parts 16 are adapted to engage within annular grooves or recesses 17 produced at the two ends of the tubular inner race 10 conveniently by a pressing, spinning or like operation. In the form of bearing shown in Figure 1 the rollers 11 are arranged contiguously side by side and it will be noted that adjacent rollers have their convolutions wound in opposite senses, the first being, say, clockwise, the next anti-clockwise, the next clockwise, and so on. This, as above mentioned, avoids the formation of grooves in the surface 14 of the member 13 and also in the external surface of the tubular member 10. Moreover, should slipping occur between the rollers and the races the helical formation of said rollers might possibly cause axial forces to be produced, tending to displace the parts of the roller bearing relatively in an axial direction, but any such tendency is avoided by arranging the rollers 11 so that half of them are wound clockwise and the other half anti-clockwise.

The method of assembling the rollers is shown clearly in Figure 2, from which it will be seen that the flexible nature of said rollers enables each of the latter to be shortened in length by deflecting it in the form of a hump indicated at 11*a*. One end 16 is, of course, previously inserted into the corresponding recess of the tubular member 10, and the deflection at 11*a* enables the opposite end of the roller 11 to be readily inserted into its corresponding recess as indicated at 16*a* and 17*a*. If desired, of course, spacing means (not shown) in the nature of a cage may be provided to separate the rollers 11, and such a cage might conveniently be adapted also to engage with the recesses 17 in the ends of the tubular member 10.

It will of course be appreciated that the tubular member 10 would normally be constructed from hardened or case-hardened steel, or from metal having good wearing properties, and that similarly the surface 14 of the outer member 13 should also be capable of withstanding the action of the rollers 11 for a reasonable length of time. The wear-resisting properties of the material of which the shaft or equivalent 12 is composed is of relatively little importance, as it is protected from the action of the rollers 11 by the tubular member 10.

In cases where the shaft or equivalent 12 is quite capable of acting as the inner race, the arrangement shown in Figure 3 may be adopted. Only one roller 11 is shown and this is the same in construction as those previously described, but the tubular member 10 is adapted to act as the outer race and has its end parts turned inwardly as indicated at 18 to form the recesses 17 for receiving the reduced end portions of the rollers 11. These rollers extend side by side for the complete circumference of the member 12, with the outer surface of which latter they engage directly. The tubular member 10 in this example would, of course, be a tight fit within the outer of the movable members indicated at 13.

If desired the improved journal bearing can be arranged to be complete with inner and outer races and such a construction is shown in Figure 4. The tubular member is again indicated at 10 and it has its end parts flanged outwardly and shaped to provide a pair of annular grooves 19 which face one another and are of substantially rectangular cross-section. These are adapted to engage with pins 20 which are securely fastened within the end convolutions of the corresponding roller 11, the latter in this

example being composed of square or rectangular section wire as indicated at 21 so as to have increased strength. The outer surface 15 of each roller is again ground to provide a substantially continuous and smooth cylindrical working surface. The outer race is constituted by a member 22 which is also tubular in form and is provided around its two ends with small inwardly directed flanges 23 which are adapted to engage with the end convolutions of the roller 11 and thus retain the outer race 22 against displacement in an axial direction. In order to facilitate the assembly and taking apart of the bearing the outer race 22 is split diagonally as indicated at 24, the arrangement being such that the edges of the split are in close engagement when the internal surface of the outer race has its proper working diameter. The split 24 is arranged obliquely with respect to the axes of the adjacent rollers in order that said rollers may pass smoothly from one side of the split to the other. Obviously this arrangement can be reversed when desirable, the inner race being split, while the outer race is formed with the annular grooves to retain the rollers.

A modified form of bearing constructed similarly to that in Figure 1 is shown in Figure 5, but in this instance a race 22*a* disposed on the outside of the bearing is in the form of a plain tube the ends of which are arranged to abut the edges 17*b* of the tubular member 10. The race 22*a* is obliquely split at 24 in order that it may be sprung over one of the edges 17*b* during assembly. The opposite arrangement is shown in Figure 6, where the tubular member 10 constitutes the outer race, while the plain, obliquely split race 22*a* is disposed inside and is located axially by the edges 17*b* of the tubular member 10. The bearings shown in Figures 4, 5 and 6 are totally enclosed and can advantageously be packed with grease during assembly, while dirt is efficiently excluded when the bearing is in service.

The use in journal bearings of rollers having the improved resilient construction has been found to give good results in practice, more particularly in aircraft work where lightness is of considerable importance. The resilient nature of the rollers enables relatively high loads to be taken, more especially where vibration occurs simultaneously, as the rollers tend to assume an oval shape, thus enlarging their area of contact with the races and so avoiding indentation of the latter.

The invention is particularly suitable for use in the elbow joints of the V-linkages used to prevent rotation of shock absorber legs, but of course it is applicable wherever a relatively light roller bearing is required for reducing the friction in a journal bearing, and it is not intended to limit its use to aircraft.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:—

1. A roller journal bearing comprising in combination a tubular member forming one race, a plurality of rollers composed of helically wound wire coils, and means upon said tubular member for engaging and retaining the ends of the rollers to hold said rollers in position against the surface of the tubular member.

2. A roller journal bearing comprising an inner tubular race, an outer tubular race, and a plurality of rollers composed of helically wound coils, one of said races being formed at each end with a radial flange having an axially directed annular groove within which the ends of the rollers engage and by which they are retained so that the rollers form a unit with the said one race.

3. A roller journal bearing as claimed in Claim 1 or 2, wherein the end parts of the rollers are of reduced diameter to engage with the retaining means upon said one race.

4. A roller journal bearing as claimed in any preceding claim wherein both ends of each roller are of frusto-conical shape to engage with the retaining means of the said one race.

5. A roller journal bearing as claimed in Claim 4, wherein the frusto-conical end parts of each roller are produced by successively reducing the diameter of those convolutions disposed at the ends of said roller.

6. A roller journal bearing as claimed in any of Claims 1 to 4, wherein there is provided at each end of each roller, a portion of reduced diameter comprising a pin or equivalent inserted into the end convolutions of the roller.

7. A roller journal bearing as claimed in any preceding claim, wherein some of the rollers have their outer surfaces composed of helices wound in one direction (e.g. clockwise) and the others are composed of helices wound in the opposite sense (e.g. anti-clockwise), for the purpose described.

8. A roller journal bearing as claimed in Claim 7, wherein alternate rollers are composed of clockwise helices, and the intervening rollers are composed of anti-clockwise helices.

9. A roller journal bearing as claimed

in any preceding claim, wherein the one race is composed of thin metal tube, the end parts of which are turned back by spinning, pressing or the like to produce a pair of annular grooves for retaining the ends of the rollers.

10. A roller journal bearing as claimed in Claim 2, wherein one race is formed with the retaining means, and the other race has a pair of inwardly directed flanges whereby it is located axially in relation to the rollers and the said one race.

11. A roller journal bearing as claimed in Claim 2, wherein one of the races is formed with the roller retaining means, and the other race comprises a plain tube which is located against axial displacement by its ends engaging with the edges of the radial flanges of the said one race.

12. A roller journal bearing as claimed in Claim 10 or 11, wherein the said other race is split so that it can be enlarged in diameter to permit the assembling of the bearing.

13. A roller journal bearing as claimed in Claim 12, wherein the said other race is split obliquely with respect to the axes of the adjacent rollers, for the purpose described.

14. An improved roller journal bearing substantially as described with reference to Figures 1 and 2 of the accompanying drawings.

15. An improved roller journal bearing substantially as described with reference to Figure 4 of the accompanying drawings.

16. An improved roller journal bearing substantially as described with reference to Figure 5 or to Figure 6 of the accompanying drawings.

Dated this 18th day of March, 1940.

For the Applicants:
F. J. CLEVELAND & COMPANY,
Chartered Patent Agents,
29, Southampton Buildings,
Chancery Lane, London, W.C.2.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1941.

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Fig. 1.

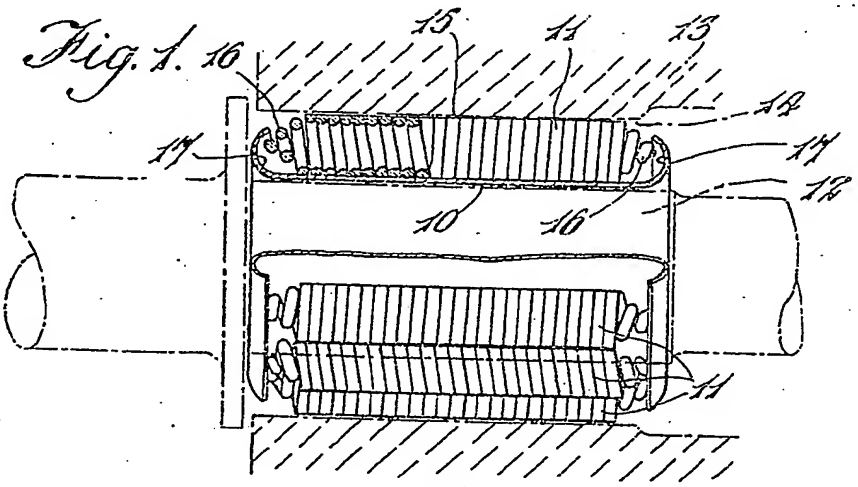


Fig. 2.

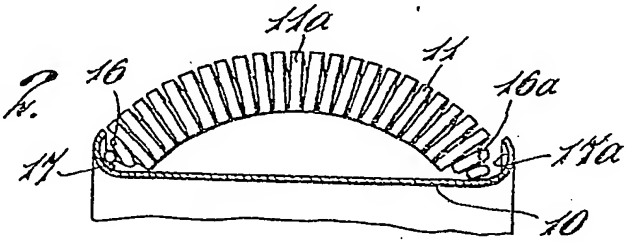


Fig. 3.

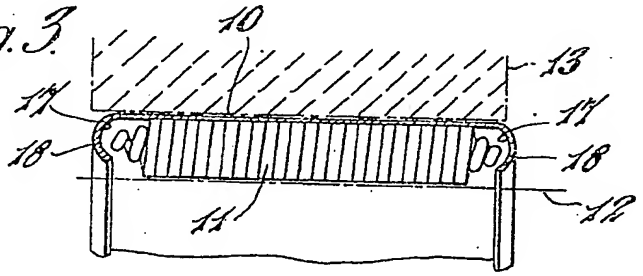


Fig. 4.

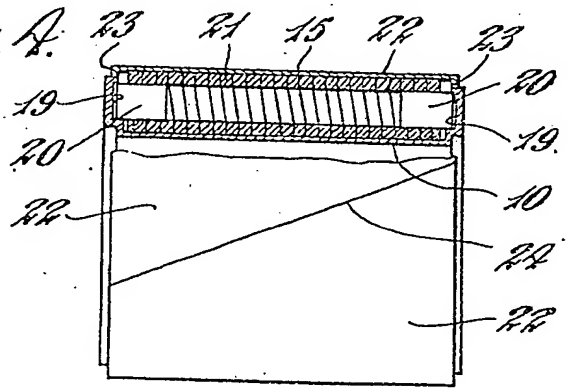


Fig. 5.

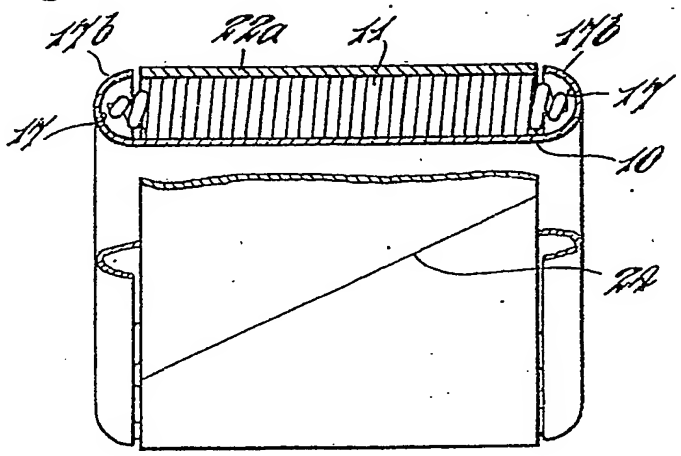
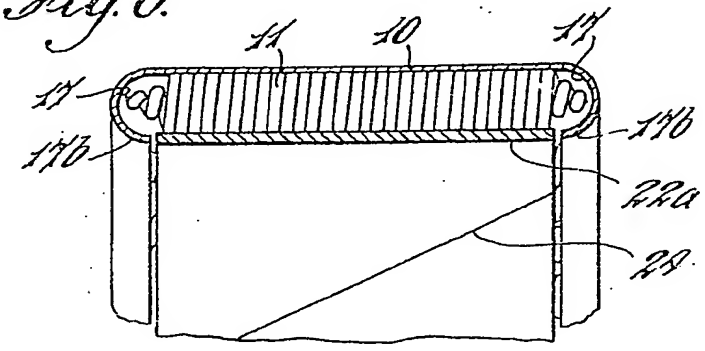


Fig. 6.



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530,342 COMPLETE SPECIFICATION

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

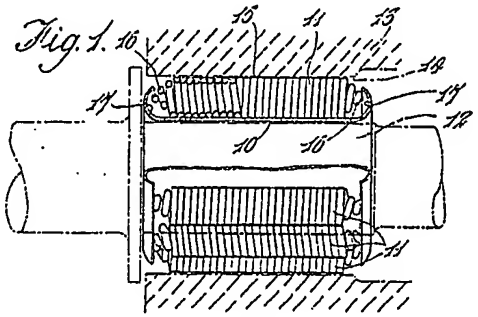


Fig. 2.

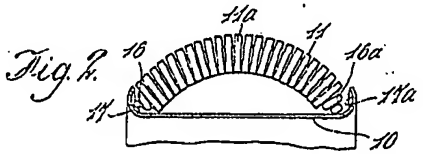


Fig. 3.

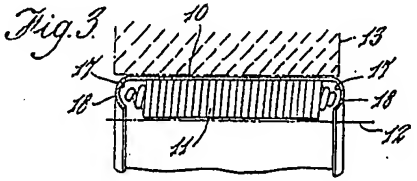


Fig. 4.

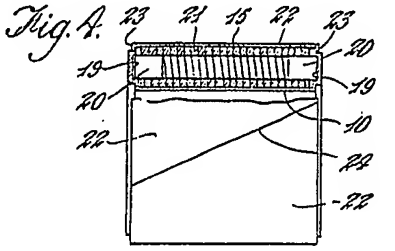


Fig. 5.

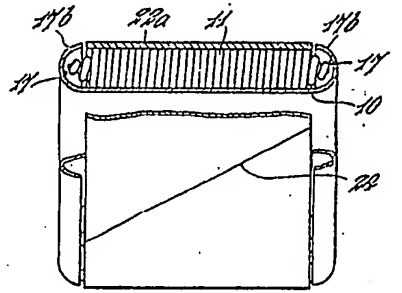
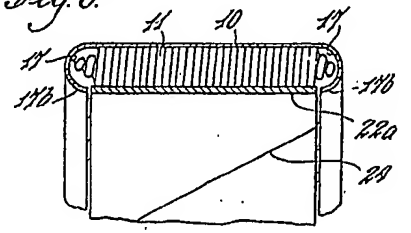


Fig. 6.



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